Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 3872-3877

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 3872-3877**
Journal homepage: http://www.ijcmas.com

Original Research Article

Analysis of Chemical Residues in Carcass of Black Bengal Goats

Subhasish Biswas[1], Sushma Kumari[2*] and Sanjay Kumar[3]

[1]Department of Livestock Products Technology, W.B.U.A.F.S., Kolkata-37, India
[2]Department of LPT, BVC, Patna, India
[3]Department of LPM, BVC, Patna, India
**Corresponding author*

Keywords

Chemical Residues in Carcass, Black bengal

A B S T R A C T

A study was conducted to detect the chemical residue analysis in Black Bengal goat in terms of organochlorine pesticide residues, heavy metal residues and antibiotic residues in different cuts of its carcass. It was observed that there was presence of these chemical residues in different concentration in carcass cut up parts, but the observation was below the MRP limit recommended by FAO/WHO and could be considered as safe from chemical residues are concerned.

Introduction

Meat is one of the most important constituents of the human diet as it provides protein, energy, minerals and vitamins. However meat could also become a source of health hazards if it contains excess fat or harmful substances such as toxins or residues of chemical origin. Residues in meat may result from many sources such as animal drugs used to prevent or treat diseases or to promote growth, pesticides, contaminated feeds and agricultural or industrial chemicals (Pullen, 1990). The chemical agents may be potential sources of residues in food, when after administration to animals, the withdrawal time, in relation to the maximum residue limit, is not taken into consideration (Burgat, 1991; Vaarkamp, 2002). Recently there has been an increasing international and local awareness of the danger of consuming meat with high levels of drug residues. Many of them are now classified as carcinogenic, toxic or allergenic. Some may also interfere with human and animal natural physiological functions. Therefore detection of these residues in meat intended for human consumption is very important for the safety of consumers (Mahgoub *et al.*, 2006). So, a trial was conducted on the above considerations.

Materials and Methods

Estimation of pesticide residues

About 50g muscle tissue from each carcass cuts from individual animal was collected for quantification of pesticide residues. The method of Kalara and Chawla (1980) & Waliszewski and Szymezynshi, (1982) with

suitable modification were followed for extraction of pesticide residues using sulphuric acid. Individual pesticide residues were detected on silica gel coated piece of 250 micron thickness by comparing the RF value with those of authenthic standards and chromatographed after developing the plates in a solvent system (Hexane: diethyl ether: acetic acid, 40:60:1, v/v) up to 6cm and in another solvent system (Heptane: acetone 98:2, v/v) upto 15cm from the point of application. The plates were exposed to iodine vapour in a closed chamber after drying. The gel area containing different pesticide residues were scraped and transferred into 20ml test tube and extracted with a known volume of chloroform. The absorbance of the standard solutions and samples were read at 280nm in a Beckman 640nm spectrophotometer. The quantity of pesticide residue was calculated. Data generated from goat meat from different cuts on various pesticide residues were analysed by one way analysis of variance. The difference between means of different meat sample from carcass cuts under particular residue was tested by least square difference (LSD) at 5% level of significance.

Estimation of heavy metal residues

The muscle samples were decomposed by wet digestion method for the determination of various metals. The method of Hall (1997) was followed with some modifications. 5g of each sample was introduced into the digestion flask.

The digestion of the samples for determination of Cu, Zn, Cd, Cr, Fe, Mn and Pb was done using tri-acid mixture of nitric acid, perchloric acid and sulphuric acid (10:4:1). Then the samples were placed on a sand bath. The digests were subsequently filtered through Whatman filter paper No. 42 and to 50ml with 2% HNO_3.The content of Cu, Zn, Cd, Cr, Fe, Mn and Pb in the sample solution was analyzed using Atomic Absorption Spectrophotometer(GBC 932plus-AAS,Australia) in flame mode using air acetylene flame. The absorption of the elements was compared with the standard absorption. The residue levels were expressed as ppm.

Estimation of antibiotic residues

A total of 30 samples were randomly collected using a scalpel blade and scissor from different cuts of Black Bengal goat. They were kept in zipped plastic bags in a chiller (4^o C) for 24 hrs before being stored at -18^o C for analyses. ELISA kits specific for antibiotic agents based on an antigen-antibody reaction were obtained from Sigma, Germany and stored at 4^o C. Enzyme substrate (Urea Peroxide) and Chromogen (Tetramethyl benzidine) were added to the wells and incubated.

Frozen samples were thawed at room temperature, fat was separated and meat was ground. About 25ml of the specific buffer was added to 10g of the ground sample, mixed for 30min., homogenized and centrifuged at 3000-rpm for 10 min. at 15^O C.The supernatant layer was decanted and the contents of the flask were dried using a Rotary evaporator and re-dissolved with the specific buffer. The solution was stored at -20^O C in small glass bottles for further analyses. Analyses were carried out in duplicates. Using a micropipette, 50 microlitre of sample supernatant was transferred into a glass tube, 450 microlitre of sample dilution buffer were added and the contents were well mixed on a vertex. 50 microlitre of each diluted standard solution and each diluted sample of antibody solution was added to each well and mixed by rocking the plate manually and the plate was incubated for 1hr at room temperature.

After that the liquid in the wells was completely removed and wells were washed with distilled water and dried completely. Then 50 microlitre of the substrate was added followed by addition of 50 microlitre of chromogen to each well. The contents were mixed and incubated for 15min. at room temperature in the dark. Finally 100 microlitre stop reagent was added to each well and mixed. The absorbance of colour was read within 60 min. after addition of stop solution in a Multiskan Spectrophotometer instrument at 405nm against an air blank. The absorbance value obtained for the sample was divided by the absorbance value of the first standard and multiplied by 100.The zero standards were thus made to 100 % and the absorbance values were expressed as percentage. The antibiotics are very unique in their structure, so specific methods and solvents had to be used for each agent. Different buffers were used with various assays described in the manufacturer directions manual attached with the kits.

Results and Discussion

Pesticide residue profile of different cuts of Black Bengal goat carcasses are tabulated in table 1. There were no differences between the residual concentration of DDT, DDE and HCH in different cuts. While considering the each of Organochlorine Phosphate (OCP) residue, it was observed that the concentration of DDE was highest amongst the two pesticide considered for estimation. Again within the cuts, the highest concentration was in the leg, neck and shoulder region. These areas wise different lodging pesticide may be due to the difference between muscular activities of the areas. It is fact that leg followed by neck are the most movable part of the body leading to the highest provision of blood circulation causing the area great risky for pesticide residual deposition. However the data analysed in the present study irrespective of cuts and OCP were all below the maximum permissible limit and all these values are far below FAO/WHO recommended limits also (Gracey and Collins, 1992), thus indicating the black Bengal goat meat marketed has pesticide residue level below MRP limit recommended by FAO/WHO and could be considered as safe in terms of organochlorine pesticide residue limits. Ahmad *et al.*, (2010) reported that 28%, 20% and 49% of the examined eggs, chicken and meat samples respectively are contaminated with OCP residues, HCH and DDT are the most prominently noticed compounds as they were detected at a high incidence. Besides consumers should be responsive about these facts while collecting retail meats particularly at the area which are prone for pesticide infestation particular where pesticides are used in abundance in the agricultural field and where the animals having certain access towards such areas.

Heavy metal residue of different cuts of bbgoat

Heavy metals from various resources particularly from industrial effluents are continuously released into aquatic and terrestrial ecosystem and therefore human habitats are affected of anthropogenic pollution. Contamination with heavy metal is therefore a serious threat because of their toxicity, bioaccumulation and biomagnifications in the food chain (Demirezen and Uruc, 2006). The grazing animals particularly goats when exposed to such contaminants used to accumulate certain amount of such heavy metal in their carcass, which come to consumer through their food chain continuously and consistently the human beings succumbed to problems associated with such toxic heavy metals (Gracey and Colins, 1992).

Table.1 Orgnochlorine Pesticide (op) residues (ug/g) profile of different cuts of black Bengal goat meat (dry weight basis)

Traits	Carcass cut up parts/ Components				
	Leg	Loin	Rack	Neck and shoulder	Breast and Shank
opDDT	0.21± 0.09	0.23± 0.11	0.20± 0.07	0.22± 0.12	0.19± 0.09
opDDE	0.59± 0.06	0.57± 0.09	0.55± 0.12	0.58± 0.08	0.54± 0.10
HCH	0.23± 0.18	0.27± 0.21	0.26± 0.19	0.25± 0.15	0.28± 0.17

Table.2 Heavy metallic residue (ug/gm) profile of different cuts of Black Bengal goats

Traits	Carcass cut up parts/ Components				
	Leg	Loin	Rack	Neck and shoulder	Breast and Shank
Arsenic (As)	0.005^{a}± 0.021	0.004^{a}± 0.011	0.004^{ab}± 0.018	0.005^{a}± 0.016	0.003^{b}± 0.013
Lead(Pb)	0.0049^{b}± 0.001	0.0048^{b}± 0.002	0.0051^{a}± 0.001	0.0052^{a}± 0.001	0.0045^{c}± 0.001
Copper(Cu)	0.37± 0.06	0.35± 0.03	0.36 ± 0.05	0.37± 0.04	0.36± 0.06
Cadmium(Cd)	0.0028^{b}± 0.001	0.0031^{a}± 0.001	0.0027^{b}± 0.001	0.0030^{a}± 0.002	0.0029^{ab}± 0.001
Cobalt(Co)	0.24± 0.42	0.26± 0.038	0.23± 0.041	0.24± 0.39	0.25± 0.40

Means on the same row with no or same superscript do not differ significantly (p>0.05)

Table.3 Mean antibiotic residue levels (ppb/kg) detected in meat from different cuts of black Bengal goat

Traits	Carcass cut up parts/ Components				
	Leg	Loin	Rack	Neck and shoulder	Breast and Shank
Tetracycline	53.34±3.1	50.23±2.8	49.65±2.5	48.51±2.6	52.98±2.3
Streptomycin	12.65±1.3	12.04±1.2	11.87±1.4	11.46±1.2	12.21±1.3
Chloramphenic	0.026±0.1	0.025±0.1	0.026±0.1	0.24±0.16	0.28±0.14
Sulphamethaze	ND	ND	ND	ND	ND

Means on the same row with no or same superscript do not differ significantly (p>0.05)

Presence of heavy metals at toxic levels has been reported from India and other countries in livestock, especially in muscle and other tissues used as meat (Rajaganapathy *et al.*, 2011). Rajaganapathy *et al.*, (2008) studied the heavy metal level in beef sample in Industrial area of Palakkad, Kerala, India. Zn, Cu and Mn concentrations were

determined in the samples of vegetables and meat foodstuffs commonly found in Manipur, India by Singh and Taneja (2010). In the present study, the concentration recorded were statistically insignificant. Only difference do exist in lead concentration between the cuts, where the highest concentration was recorded in neck and shoulder, while the least was in breast and shank. When observing the Cu concentration the observations were more or less uniform in all the cut up parts, While in Cd a difference existed between the cuts but in regard to Co the results were again like Cu. Such observation can substantiate the fact that residual concentration in the muscle tissue were at a very low level and were well below than the maximum residual level as recommended by FAO/WHO.

Antibiotic residue of different cuts of black Bengal goat meat

The range of tetracycline levels detected in the current study (44-53ppb/ kg) is below the allowable international level. Limits of quantification for various tetracycline compounds in bovine, swine and poultry muscles were estimated between 1 (Chlortetracycline) –9nanogram/g (4-epioxytetracycline) and are well below the tolerance levels set by the European Union (Bogialli *et al.,* 2006). However the presence of residues indicates that animals have been treated with the drug and probably not allowed an adequate withdrawal period. Presence of antibiotic residues may be responsible for increasing levels of tolerant bacteria or drug sensitive in some cases. Streptomycin levels in the current study were ranged between 0-20ppb/kg with a mean of 11ppb/kg, which is very low, according to EU MRL. The maximum residue limit (MRL) for streptomycin stated by EU regulations is 500 ppb in meat sample.

Chloromphenicol is a broad spectrum antibiotic which is frequently employed in animal health for its excellent anti-bacterial and pharmacokinetics properties. Chloramphenicol levels in the present study were low compared to the 100nanogm/kg specified as maximum limit. Sulphonamides are widely used as feed additives for Calves, pig and poultry. They are also used for treating intestinal infections and other systemic diseases. Sulphonamide residues may therefore occur in food of animal origin such as meat and milk. In the US, the tolerance for residues of sulpha in uncooked tissues is 0.1 ppm and the withdrawal time is 15 days (Augsburg, 1989).The EC regulations (No.675/92 have established a MRL of 100ppb for sulphonamides in meat. Levels of sulphonamides in goat meat from different cuts were negligible as most of the samples contained detection levels of <1 ppb/kg.

This finding indicated that black Bengal goat meat sold in WB generally contains residues of antibiotic agents. Although these levels are within allowable limits, their presence above MRL may still be regarded as health hazard as they may cause allergic reactions or produce drug tolerant bacteria.

References

Ahmad, R., Salem, N.M. and Estaitieh, H. 2010. Occurence of organochlorine pesticide residues in eggs, chicken and meat in Jordan. Chemosphere 78:667-671.

Augsburg, J.K. 1989.Sulfa residues in pork: an update. Journal of Animal Science 67:2817.

Bogialli, S. Curini, R., Di Corcia, A., Lagana, A. and Rizzuti, G. 2006. A rapid confirmatory method for analyzing tetracycline antibiotics in bovine, swine and poultry muscle

tissues. Journal of Agricultural and Food Chemistry 54:1564-1570.

Burgat, V. 1991. Residues of drugs of veterinary use in food. La Revue du praticien 41:985.

Demirezen, D. And Uruc, K.2006. Comparative study of trace elements in certain fish, meat and meat products. Meat Science 74: 255-260.

Gracey, J. and Collins, D. 1992. Chemical residues in meat. Meat hygiene. ELBS Baillere Tindall. The Bath Press, London, 202-221.

Hall, E.M. 1997. Determination of trace elements in sediments. In Mudroch, A., Azcue, J.M. and Mudroch, P. (Eds.), Manual of physicochemical analysis of aquatic sediments. Lewis Publishers, USA. pp 85-145.

Kalara, R.I. and Chawla, R.P. 1980. Final Technical Report on PL-480 Project: Studies of pesticide residues and monitoring of pesticide pollution. Department of Entomology, PAU, Ludhiana.

Mahgoub, O., Kadim, I., Mothershaw, A., Al. Zasjali, S. and Annamalai, K. 2006. Use of enzyme linked immunosorbent assay (ELISA) for detection of antibiotic and anabolic residues in goat and sheep meat. World J.Agric.Sci. 2:298-302.

Pullen, M. 1990. Residues. Chapter 6 in meat and health advances in meat research, vol.6, Ed.A.M. Pearson and T.R. Dutson. New York: Elsevier Applied Science.

Rajaganapathy, V., Xavier, F. Saseendran, P.C. and Oommen, G.T. 2008. Study of heavy metal level in beef sample in industrial area of Palakkad, Kerala, India. Proceedings of National Symposium on Safe Meat for Good Health and Environment.July4- 5, Bangalore, India. pp37-38.

Rajaganapathy, V., Xavier, F., Sreekumar, D. and Mandal, P.K. 2011. Heavy metal contamination in soil, water and fodder and their presence in livestock and products: A review. J.Environ.Sci.Technol. 4(3):234-249.

Singh, K.B. and Taneja, S.K. 2010. Concentration of Zn, Cu and Mn in vegetables and meat foodstuffs commonly available in Manipur: A north-eastern state of India. Elec. J. Env. Agricult. Food Chem. 9(3):610-616.

Vaarkamp, H. 2002. Maximum residue levels (MRLs) of veterinary medicines in relation to food safety. MRLs really do matter –the Benzaprocpen case. Tijdschrift Voor Diergeneeskunde 127:2.

Waliszewski, S. and Szymczynski, G. 1982. Simple low-cost method for determination of selected chlorinated pesticides in fat samples. Journal-Association of Official Analytical Chemists65:677.